† 157 DOPPLER FLOW INDICES IN THE CENTRAL AORTA OF NEONATES. Deborah M. Friedman, M.D., Fredrick Z. Bierman, M.D., Division of Pediatric, Columbia-Presbyterian Medical Center, N.Y., N.Y.

Gated pulsed Doppler echocardiography (GPDE) allows non-invasive examination of cardiac index. Regional systolic blood flow (RSBF), however, is a more relevent parameter in many congenital cardiovascular anomalies. This study examined the central aortic systolic waveform in normal neonates to establish indices of regional systemic systolic blood flow in the ascending and descending aorta. Combined subxyphoid two dimensional and GPDE were performed in the ascending and descending aorta of twenty normal neonates, 68+/-13 hours of age. The peak systolic frequency (PSF), frequency time intergral (FTI), cycle length and ejection time were measured and corrected, when indicated, for incident echo beam angle. The calculated RSBF in the ascending aorta was 4.04 (+/-11%) liters per minute per meter squared (L/min/m2) and 2.58 L/min/m2 (+/-25%) in the descending supraceliac thoracico-abdominal aorta. These values were comparable to the historical normal values of 2.8-4.6 and 2.1-3.5 liters/min/meter 2, respectively. A linear relationship, independent of cycle length, existed between the FTI and the corrected peak frequency. The FTI represents a rate independent ejection phase index of effective stroke volume. Noninvasive quantitation of ascending and thoracico-abdominal descending aortic blood flow should be a useful adjunt in evaluating cardiovascular anomalies of the neonate and therapuetic interventions for their management.

158 MYOCARDIAL ISCHEMIA IN PULMONARY ATRESIA WITH INTACT VENTRICULAR SEPTUM

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Children dying after operation for pulmonary atresia and intact ventricular septum (PA-IVS) may have evidence of myocardial ischemia. The etiology of ischemia in these patients is unknown. We assessed the relationship between myocardial ischemia and the presence of right ventricular to coronary artery fistulae in necropsy specimens from 17 patients (pts) with PA-IVS. Age at death was from 1 day to 16 years (mean 17 months). Six of 17 pts (35%) had right ventricular to coronary artery fistulae, 5 of whom had coronary dysplasia. Three pts had segmental or complete absence of a coronary artery. Histologic evidence of M.I. was present in 4/6 pts, 2 of whom had RV outflow reconstruction. Six of 11 pts without right ventricular to coronary artery fistulae had myocardial ischemia. Of these, 4 had right ventricular outflow reconstruction and 2 had shunt operations. Death occurred from 1 to 8 days (mean 3 days) postoperatively.

Pts with PA-IVS may have myocardial ischemia with or without either right ventricular to coronary artery fistulae or coronary dysplasia. Myocardial ischemia may follow right ventricular outflow reconstruction or shunt operations. Thus, myocardial ischemia occurs commonly with PA-IVS and does not always relate to coronary abnormalities or right ventricular outflow reconstruction. Myocardial ischemia may be due to poor subendocardial perfusion of a small chambered, yet hypertrophic and hypertensive ventricle.

159 NONINVASIVE EVALUATION OF PULMONARY ARTERY BAND GRADIENTS BY CONTINUOUS WAVE DOPPLER ECHOCARDIOGRAPHY

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Continuous wave (C.W.) doppler echocardiography can non-invasively estimate pressure gradients across stenotic cardiac valves. In order to assess validity and feasibility of non-invasive C.W. doppler pressure measurement in children with congenital heart disease, we studied 12 patients (pts.) with pulmonary artery bands (PAB). Simultaneous C.W. doppler and catheter pressure gradients across the PABs were obtained in each pt. Five males and 7 females were aged from 6 months to 26 years (mean 5.6 years). The great arteries were normally related in 6 pts, L-malposed in 4 and D-malposed in 2. Maximal peak C.W. doppler velocity measurements were recorded from either suprasternal, parasternal or subcostal positions using a 2 MHz Pedof non-imaging tranducer. C.W. doppler pressure gradients (Δ P) was calculated using $\Delta P = 4 V^2$ where V=maximum velocity in meters/sec. C.W. doppler gradients ranged from 23 to 92 mm Hg (mean=64 mm Hg) and simultaneous peak catheterization gradients from 30 to 94 mm Hg (mean=63 mm Hg). C.W. doppler underestimated catheterization gradients in 5 cases by from 2 to 11 mm Hg (mean=8 mm Hg) and overestimated catheterization in 7 cases by from 1 to 20 mm Hg (mean=8 mm Hg). C.W. doppler can accurately and non-invasively measure PAB gradients in children with various congenital lesions. This may avoid repeated catheterization in selected cases.

† 160 NEONATAL CARDIOVASCULAR EFFECTS OF VERAPAMIL. Norman Gootman, Barbara J. Buckley, Nancy A. Kaplan, Peter G. Griswold, Barbara J. Peterson. Schneider Children's Hospital, Long Island Jewish- Hillside Medical Center, Department of Pediatrics, New Hyde Park, NY

Because pediatric studies of verapamil (V) are few, the cardiovascular effects of the clinical dose range were examined in 1 day and 2 week old anesthetized swine: 100 or 300 ug/kg verapamil (V) was infused iv over 2 min. Blood pressure (BP), LV dP/dt max, heart rate (HR) and phasic superior mesenteric (Mes), renal (Ren) and femoral (Fem) arterial blood flows (F) were recorded and vascular resistances (R) calculated. Maximum responses (mean % $\pm$ SE) occurred at the end of the infusion:

Age	1 day		2 weeks	
Dose (ug/kg)	100	300	100	300
n	8	7	9	9
BP	-4±1	-20±3	-9±2	-18±4
HR	NS	-12±3	+6±3	NS
LV dP/dt max	-15±3	-43±7	-7±1	-18±4
MesF	-11±5	-18±7	NS	-17±6
MesR	+11±8*	NS**	-13±3	NS
RenF	NS	-15±3	NS	-10±4
RenR	NS	NS**	-8±2	-9±4
FemF	NS	-18±4	NS	NS
FemR	NS	NS	NS	NS

*responses varied in magnitude;**-7% during 1st min of infusion

HR remained increased 30 min after 100 ug/kg V in 2 week olds. At 30 min after 300 ug/kg V, there were still decreases in BP in all, and LV dP/dt, HR and FemF in day olds. HR and FemF decreased 3-30 and 10-30 min, respectively, after 300 ug/kg V in 2 week olds. The results indicate that V has both age- and dose-dependent cardiovascular effects in newborn swine and suggest that V should be used with caution in infants.

161 RESPONSE OF NEWBORN LAMB TO ISOPROTERONOL INFUSION. Erik A. Hagen, Willa H. Drummond, Hugh H. Shrager, Wendy A. Dailey, September L. Evans, University of Florida, Department of Pediatrics, Gainesville, Florida.

We studied 6 chronically instrumented newborn lambs during normoxia (N) and hypoxia (H) on alternating days during infusion of isoproteronol (I) from .062 to 2.5 mcg/kg/min while measuring PAP, LAP, SAP, pulmonary flow (QP) heart rate (HR) and blood gases. Pulmonary (PVR) and systemic vascular resistance (SVR) and PVR/SVR were calculated. Infusion during N resulted in decreased SAP, PVR, SVR and increased HR, QP, and PVR/SVR. During H+I compared to N base, SAP, and SVR decreased and PAP, PVR, HR, QP, and PVR/SVR increased. QP increased significantly during H alone, and did not increase further with I infusion. Changes from N base to H base were not increased further when H+I was compared to H base except for HR which rose from 271±8 to 320±19 ml/kg/min.

	SAP	PAP	LAP	QP	SVR	PVR	PVR/SVR	HR	pH	PCO_2
N+I	↓+	NS	NS	↑*	↓+	↓	↑	↑+	↓+	NS
H+I	↓*	↑+	NS	↑	↓*	↑	↑+	↑	↓+	NS

* = $p<.05$, + = $p<.002$ (vs N base), NS = Not Significant.

No arrhythmias occurred with I, but one lamb required resuscitation when QP fell to zero and respiration ceased during H+I at 2.5 mcg/kg/min. A significant persistent metabolic acidosis occurred during both H and N and continued into the recovery periods. Neonates may not benefit from isoproteronol infusion under hypoxic conditions.

●162 CARDIOVASCULAR PERFORMANCE IN SICKLE CELL DISEASE. William E. Hellenbrand; Jay Brown; Wesley Covitz; Diane Gallagher; Major Geer; Sanford Leff; Norman S. Talner. For the Cooperative Study of Sickle Cell Disease, National Institutes of Health, Bethesda, Md.

Cardiopulmonary studies including clinical evaluation, ECG, echo, nuclear imaging, and exercise responses were performed on 156 patients (mean age 21 years, range 5 to 60) with homozygous sickle cell (SS) disease (mean hemoglobin 8.2±1.2 gm/dl). LVH by ECG criteria was present in 45% but in only 25% by echo measurements. LV dilatation was also noted in 20% (echo). Left atrial enlargement by ECG criteria was evident in 5% but left atrial dilatation by echo was noted in 26%. With graded bicycle exercise (n=110) only 40% reached 50% of predicted maximal work load (Wmax) with no patients reaching Wmax. The level of work completed was inversely related to age with 54% of the patients under 20 years of age achieving 50% of Wmax while no patients over 40 years of age were able to reach this level of work. Maximal levels of VO_2 achieved were decreased at 19.5±7.9 ml/kg/min while the respiratory quotient was greater than 1 at less than 50% of Wmax in all patients exercised. An ischemic response (ST depression) to exercise was noted in 39%. Again, this was inversely related to age with only 19% of patients under 20 and 80% of patients over 40 showing ST depression. The left ventricular ejection fraction response to exercise was abnormal in 25%. In patients under 20 years of age the abnormal response was present in only 4% and in patients over 40 this was present in 40%. All patients with SS disease thus evidenced decreased exercise performance primarily on the basis of decreased O_2 carrying capacity. This may be associated with decreased pump function and myocardial ischemia in some patients.